ARGUS LCM

Patient monitor
ARGUS LCM and ARGUS LCM PLUS

Art. no.: 2.510474 rev.: d

Operating Instruction

SCHILLER

The Art of Diagnostics

Sales and Service Information

The SCHILLER sales and service centre network is world-wide. For the address of your local distributor, contact your nearest SCHILLER subsidiary. In case of difficulty a complete list of all distributors and subsidiaries is provided on our internet site: http://www.schiller.ch.

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1 Safety notes

1.1 Responsibility of the user

- This device must only be used by qualified doctors or trained medical personnel under their direct supervision.
- The numerical and graphical results and any interpretation given must be examined with respect to the overall clinical condition of the patient and the general recorded data quality.
- The indications given by this equipment are not a substitute for regular checking of vital functions.
- Specify the competencies of the personnel for operation and repair.
- Ensure that the personnel have read and understood these operating instructions and in particular this chapter “safety notes".
- Have damaged or missing components replaced immediately.
- The operator is responsible for compliance with all applicable accident prevention and safety regulations.

1.2 Intended use

- The ARGUS LCM/PLUS is a patient monitoring device used for the measuring of the parameters of a patient, including ECG, SpO_2, CO_2, non invasive blood pressure, temperature and respiration.
- The system is suitable for internal hospital transport.
- There is no danger for patients with pacemaker.
- The device is only intended for single patient use.
- Only operate the device in accordance with the specified technical data.
- The system is **not** designed for sterile use nor is it designed for outdoor use.
- Do **not** use this unit in areas where there is any danger of explosion or in the presence of flammable gases such as anaesthetic agents.
-  This unit is CF classified. It is defibrillation protected only when the SCHILLER original patient cable is used. However, as a safety precaution when possible, remove electrodes before defibrillation.
- This product is not designed for direct cardiac application.

1.3 Organisational measures

- Before using the unit, ensure that an introduction regarding the unit functions and the safety precautions has been provided by a medical product representative.
- Keep these operating instructions in an accessible place for reference when required. Make sure that they are always complete and legible.
- Observe the operating instructions and maintenance instructions.
- These operating instructions do not override any statutory or local regulations, or procedures for the prevention of accidents and environmental protection.

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1.4 Safety-conscious operation

- ▲ Make sure that the staff has read and understood the operating instructions - particularly the "Safety Notes" chapter.
- ▲ Position the device so that there is no possibility of it falling on the patient or floor.
- ▲ Do not touch the unit casing during defibrillation.
- ▲ To grant the patient's safety, it must be ensured that neither the electrodes, including the neutral electrode, nor the patient, or persons touching the patient, come into contact with conducting objects (e.g. RS-232 interface - see Fig. 3.1 on page 15), even if these are earthed.
- ▲ Immediately report any changes that impair safety (including operating behaviour) to the person responsible.
- ▲ Do not place any liquids on the unit. If liquid should be spilled over the device, immediately disconnect the device from the mains and wipe it. The device must be serviced before reusing.

1.5 Safety facilities

- ▲ Operating the device without the correctly rated fuse, or with defective cables, constitutes a danger to life. Therefore:
  - – Do not operate the unit if the earth connection is suspect or if the mains lead is damaged or suspected of being damaged.
  - – Damaged cable connections and connectors must be replaced immediately.
  - – The electrical safety devices, such as fuses, must not be modified.
  - – Ruptured fuses must only be replaced with the same type and rating as the original.

1.6 Operation with other devices

- ▲ Use only accessories and other parts recommended or supplied by SCHILLER AG. Use of other than recommended or supplied parts may result in injury, inaccurate information and/or damage to the unit.
- ▲ Ancillary equipment connected to the analogue and/or digital interfaces must be certified according to the respective IEC standards (e.g. IEC/EN 60950 for data processing equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC/EN 60601-1-1. Everybody who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC/EN 60601-1-1. If in doubt, consult the technical service department or your local representative.
- ▲ Any other equipment used with the patient must use the same common earth as the ARGUS LCM.
- ▲ Precautions must be observed when using high frequency devices. Use the frequency SCHILLER patient cable to avoid possible signal interference during ECG acquisition.
- ▲ There is no danger when using the ECG unit simultaneously with electrical stimulation equipment. However, the stimulation units should only be used at a sufficient distance from the electrodes. If in doubt, the patient should be disconnected from the monitor.
- ▲ If the patient cable should become defective after defibrillation, a lead-off indication is displayed in the upper right part of the screen and an audible alarm is issued.

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1.7 Maintenance

- ▲ Danger of electric shock! Do not open the device. No serviceable parts inside. Servicing may only be carried out by a qualified technician authorised by Schiller AG.
- ▲ Before cleaning and to isolate the mains power supply, switch the unit off and disconnect it from the mains by removing the plug.
- ▲ Do not use high temperature sterilisation processes (such as autoclaving). Do not use E-beam or gamma radiation sterilisation.
- ▲ Do not use solvent or abrasive cleaners on either the unit or cable assemblies.
- ▲ Do not, under any circumstances, immerse the unit or cable assemblies in liquid.

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1.8 Safety symbols and pictograms

1.8.1 Symbols used in this user guide

The safety level is classified according ANSI Z535.4. The following overview shows the safety symbols and pictograms used in this manual

For a direct danger which could lead to severe personal injury or death.

For a possibly dangerous situation, which could lead to heavy bodily injury or death.

For a possibly dangerous situation which could lead to personal injury. This symbol is also used to indicate possible damage to property.

For general safety notes as listed in this chapter.

Used for electrical dangers, warnings and other notes in regarding operation with electricity.

NOTE For possibly dangerous situations, which could lead to damages to property or system failure or **IMPORTANT** for helpful user information.

Reference to other guidelines

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1.8.2 Symbols used on the device

Potential equalisation

CF symbol. This unit is classified safe for internal and external use. However, It is only defibrillation protected when used with the original SCHILLER patient cable!

The unit/component can be recycled.

CE 0123

Notified body of the CE certification (TÜV P.S.)

Note: Follow the instructions in the documentation.

1.9 Additional terms

1.9.1 Implied authorisation

Possession or purchase of this device does not convey any express or implied license to use the device with replacement parts which would alone, or in combination with this device, fall within the scope of one or more patents relating to this device.

1.9.2 Terms of Warranty

Your SCHILLER ARGUS LCM/PLUS is warranted against defects in material and manufacture for the duration of one year (as from date of purchase). Excluded from this guarantee is damage caused by an accident or as a result of improper handling. The warranty entitles free replacement of the defective part. Any liability for subsequent damage is excluded. The warranty is void if unauthorised or unqualified persons attempt to make repairs.

In case of a defect, send the apparatus to your dealer or directly to the manufacturer. The manufacturer can only be held responsible for the safety, reliability, and performance of the apparatus if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorised by him, and
- the ARGUS LCM/PLUS and approved attached equipment is used in accordance with the manufacturer's instructions.

There are no express or implied warranties which extend beyond the warranties hereinabove set forth. SCHILLER makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.

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2 Introduction

The ARGUS LCM/PLUS (**L**ow Weight and **C**ompact **M**onitor) is a flexible patient monitoring device for the comprehensive monitoring of vital parameters in adults, children and neonates.

Mains power supply (115/230 VAC) is used for stationary use. The LCM also provides full vital data monitoring during transport with the built in battery (one hour), or using a DC voltage supply (11 - 30 VDC).

2.1 Version overview

2.1.1 ARGUS LCM (basic) from serial number 781.000-781.999

The following table shows the equipment of the ARGUS LCM. This basic device cannot be upgraded.

ARGUS LCM	ECG	SpO_2	NIBP
Basic device	Only with 3 leads/display one lead (II)	x	x
Options: printer, additional battery (can be updated in the field)			

2.1.2 ARGUS LCM (basic) from serial number 781.1000 and higher

The ARGUS LCM BASIC with the microprocessor MK19-11 has a new ECG amplifier (3p). It is now possible to to display 6 leads with a 3p-lead cable. The 3p-lead cable is marked with a black connector housing instead of green.
This works only with software 1.24 and higher.

ARGUS LCM version	[a]ECG	SpO_2	NIBP	Respiration	Temperature	$etCO_2$	IBP
A	x	x	x	x	1x		
B	x	x	x	x	1x	x	
D	x	x	x	x	1x		x
E	x	x	x	x		x	x

[a] Monitoring amplifier only with 3p- and 5 lead cable (6 or 7 lead display)
Options for all versions: printer, additional battery and nurse call or vehicle power supply
Version A can be updated with $etCO_2$ module, printer and additional battery.
Version B/C/D/E can be updated with printer and additional battery

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2.1.3 ARGUS LCM PLUS (from 780.001and higher)

ARGUS LCM PLUS version	[a]ECG	SpO_2	NIBP	Respiration	Temperature	$etCO_2$	IBP
A	x	x	x	X	1x		
B	x	x	x	x	1x	x	
D	x	x	x	x	1x		x
E	x	x	x	x		x	x

[a] Diagnostic amplifier only with 3- or 5- or 10 lead cable (1- or 7- or 12 lead display)
Options for all versions: printer, additional battery and nurse call or vehicle power supply
Version A can be upgrade with $etCO_2$ module, printer and additional battery.
Version B/C/D/E can be upgrade with printer and additional battery

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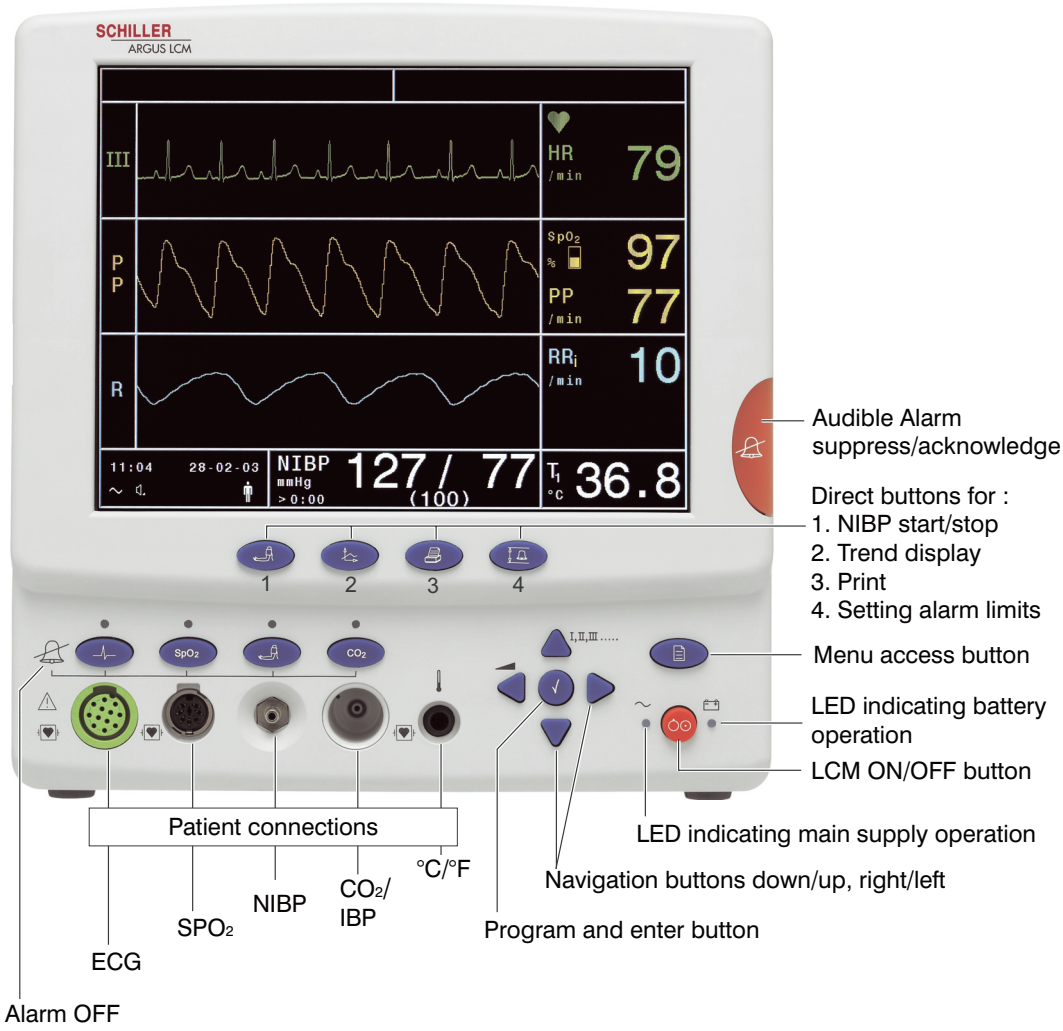
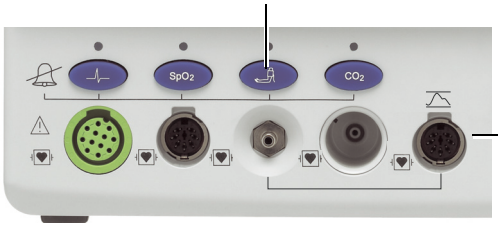
2.2 Functional overview

2.2.1 Buttons of the Argus LCM PLUS



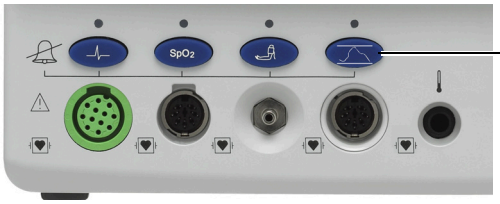
Access to the menu IBP and NIBP alarm on/off and IBP calibration.

This is the LCM plus version E.



IBP connection instead of Temperature

This is the LCM plus version D.



IBP connection instead of CO_2

Fig. 2.1 ARGUS LCM front view

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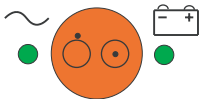
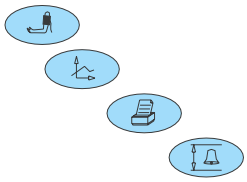
2.2.2 Description of buttons



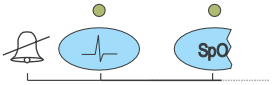
ON/OFF
The LED indicates if the LCM is running from mains power or battery.

Button for suppression/acknowledgement of audible alarms
The alarm can be suppressed or acknowledged in two ways. This is defined in settings **About+/Alarm setup menu**.

See detailed description in paragraph 3.7.3



Direct buttons for:
(1) NIBP start/stop or, if pressed for 2 s, switch between auto and manual
(2) Trend and alarm displays
(3) Printout of the current display
(4) Alarm limit settings



Alarm off
These buttons disable alarms of the individual parameters. Acknowledgement is displayed on the top left e.g. **ECG Alarm OFF**. The LED above the corresponding button is lit (for details refer to section 3.7.4).

Menu access

Opens the main menu. Navigate through the menus with the **right/left** buttons. Press the menu button to again leave the menu.

Enter

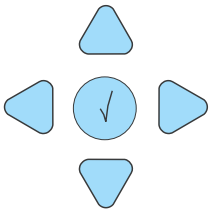
The navigation and enter buttons have different functions dependent on operating mode:

Normal single lead display:
Pressing the enter button shows the first 3 leads instead of the single lead display.

By pressing the **up/down** buttons, the next lead, or lead group is displayed.

Press the **left** button to adjust the loudness of the audible alarm and the QRS signal.

Navigation



Programming mode:
1. Activating the programming mode with the **menu** button.
2. Selecting the menu with the **left/right** buttons.
3. Selecting a value with the **up/down** buttons.
4. Press the **enter** button.
5. Change a value using the **up/down** buttons.
6. Retrieve a value by pressing **enter**.

Trend display mode:
Activate the trend display mode with the **trend display** button.
Use the
left/right buttons to move forward/backward in the trend display.
Use the **trend** button to toggle between the trend display, alarm display and normal monitor display.

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2.2.3 Description of display

Alarms

(1) Status field for physiological alarms

(2) Status field for technical alarms

Curve field

(3) 1 or 3 channel leads display. With **enter** display 1 or 3 leads, with **up/down** select the following/previous lead/lead group.

System status field

(4) System status field

(5) Symbol for battery operation.

(6) Loudness (3-step) for alarm- and QRS-sound. Adjust with **left** button.

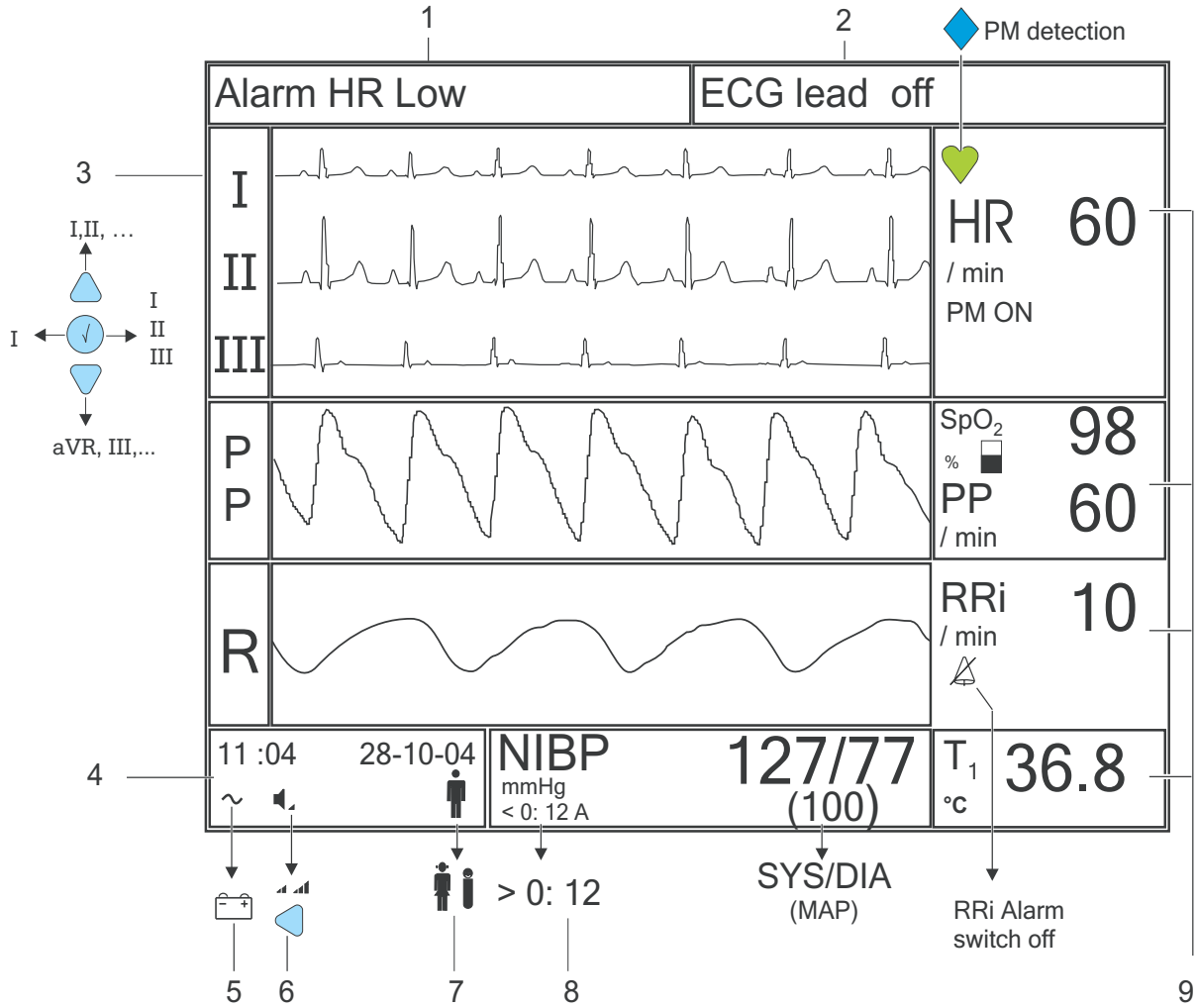
(7) Symbol of the selected patient type.

Blood pressure

(8) **< 0:12 A** = remaining time (h/min) to the next automatic blood pressure measurement.
> 0:12 = Time since the last manual blood pressure measurement
Remark: During blood pressure measuring the actual system pressure in mmHg will be displayed.

Measurement field

(9) Various displayed values e.g. HR, $Sp0_2$, IBP, CO_2, RRi, temperature.



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3 Operation

3.1 Start-up

DANGER

▲ Danger of electrical shock. Do not operate the unit if the earth connection is suspect or if the mains lead is damaged or suspected of being damaged.

3.1.1 Connecting and power on

(1) RS-232
(2) Mains connection (100 -115 or 220 -240 VAC)
(3) Potential equalisation
(4) Nurse call or DC in 11 - 30 VDC (option)

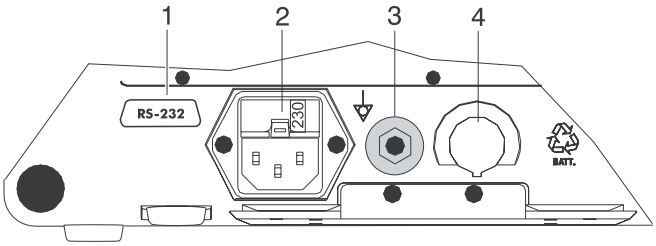
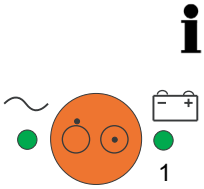


Fig. 3.1 ARGUS LCM back panel

1. Voltage setting (2) 115 or 230 V. Refer to chapter 5.3 for the mains voltage. Connect the power cable at the rear of the unit (2).
2. Connect the potential equalisation cable (3) to the central potential equalisation socket.
3. Press the **on/off** button.
4. Check that all LEDs flash shortly and there is a beep on start-up.
5. Check the settings according to sections 3.4 and 7.1.

3.1.2 Battery operation



Important
The Battery operation is indicated by the LED below the battery symbol.

When the battery charge is low, the alarm message **Battery low** appears or

– the LED (1) blinks
– the Battery symbol in the bottom left display field blinks

for Battery recharging refer to chapter 5.2

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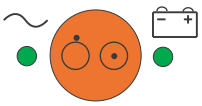
3.1.3 Operation with external dc voltage

Important
Before initial operation with external dc voltage, check voltage supply. (The voltage must be in the range of 11-30 VDC). On connection, make sure that the polarity is correct.

3.2 Switching off and disconnecting from mains



1. Press the **on/off** button. A dialogue window appears.
2. Select with the **left** button **YES** and confirm the selection with the **enter** button.
3. Remove the mains cable from the mains supply socket (2) (see Fig. 3.1) to isolate the device from the mains.

Important
If no dialogue window appears, it is possible to switch off the device by keeping the **On/Off** button pressed for 10 seconds.

3.2.1 Interruption of the mains supply

If the mains supply is interrupted, the device automatically switches over to battery operation. The user settings are maintained. These settings can be saved in the menu **About+/Software**.

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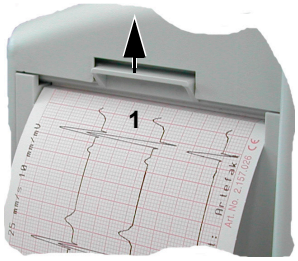
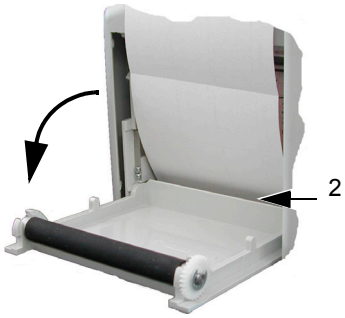
3.3 Inserting printing paper

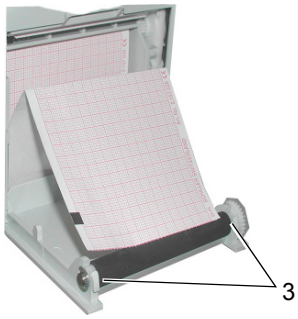
Important

The device is delivered without printing paper installed. Only use original SCHILLER printing paper. The thermo-paper is sensitive to heat, humidity and chemical vapours. Store the paper in a cool and dry area.

1. Press the locking catch **(1)** upwards. The printer door opens downward
2. Insert paper and pull it up. Be sure that the paper lies behind the cover **(2)**.
3. Close the cover. Be sure that the paper lies exactly between the rails **(3)**.







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3.4 Initial settings

This chapter details the most important and typical programming sequences.

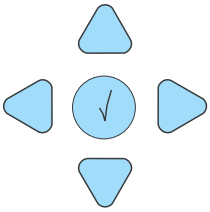
WARNING

▲ Only authorised personnel, trained in the operation of this device, are permitted to do the setups in the following menu.

The extended menu is displayed by pressing the following button combination:

Press  ; select **About**; press  and then  .

3.4.1 Selecting the language



1. Open the menu **About/Device**.
2. Confirm with the **enter** button.
3. Press the **down** button and select the language.
4. Confirm with the **enter** button.
5. Press **right/left** to move to the next menu and continue with more setups.
6. Save the user settings. Open the **Software** panel, select **Save as Default** and confirm with the **enter** button.
7. Return to the normal display mode by pressing the **menu** button.

For system settings, see detailed list in the sections 7.1.1and 7.1.2.

3.4.2 Saving and restoring default values

Changed values can be saved permanently and restored. See section 7.1.2.

1. Open the **About+** panel and select **Device**.
2. Select **Save as Default** or **Restore Defaults** and confirm with **enter**. The default values will then be saved or restored.
3. Press the **menu** button to exit the programming mode.

3.4.3 Load factory defaults

When the factory defaults are loaded, the system language will be German.

The SCHILLER factory defaults are listed in section 7.2. When you load these defaults, they will overwrite the user settings.

1. Open the **About+** panel and select **Device**.
2. Select **Factory Defaults** and confirm with the **enter** button. The factory defaults will be loaded.
3. Press the **menu** button to exit the programming mode.

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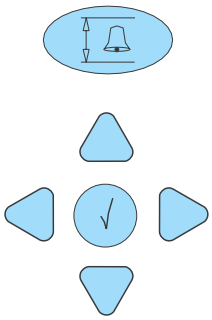
3.4.4 Alarm limit setting



All alarm limits are reset to the default or user specific system settings after switching the unit off/on, if they have not been stored as default. (see menu **About+/Software**)

1. Press **alarm limit** button.
2. Press **up/down** or **left/right** buttons to select an alarm parameter and confirm with **enter**. The entry field appears blue.
3. Press **up/down** to change the value and confirm with the **enter** button.
4. Press the **up/down** or **left/right** buttons to select other parameters or press the **alarm limit** button to exit the menu.

The following table gives the default alarm limits settings for adults. A changed value can be stored as default in the menu **About+/Software**.

The factory defaults are listed in the sections 7.1 and 7.2..

Alarm	Low	High	Unit	[a]Prio.	[b]Print
HR	50	140	/min	High	Off
ASYS	-	2	s	High	Off
[c]RRi	8	35	min	Low	Off
[c]APNi	-	25	s	High	Off
SpO_2	90	101	%	Low	Off
PP	50	140	min	High	Off
SYS	100	140	mmHg	Low	Off
DIA	40	95	mmHg	Low	Off
MAD	70	140	mmHg	Low	Off
Ps	95	180	mmHg	Low	Off
Pm	50	100	mmHg	Low	Off
Pd	40	100	mmHg	Low	Off
eCO_2	35	45	mmHg	Low	Off
CO_2 i	0	2	mmHg	Low	Off
RRc	8	35	/min	Low	Off
APNc	-	25	s	High	Off

a. "High" priority = audible signal with 2 x 5 impulses.
"Low" priority = audible signal with 1 x 2 impulses and 20 s pauses between the impulse sequences.
b. Print "On" = Default printout containing a warning message when the min./max. value is exceeded.
c. If the RRi alarm option is **Off** in the **ECG** settings panel, the "Low" and "High" values for RRi and APNi will be "Off".

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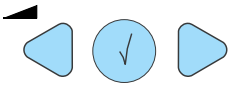
Printing alarm limits

1. Press the **alarm limit** button.
2. Press the **print** button. The displayed table is printed.

3.4.5 Setting loudness of audible alarm and QRS sound



1. Select normal monitor mode. Press **menu** if in programming mode or **trend** if in trend display.
2. Press the **left** button to adjust the loudness. The pictogram in the status display on the bottom left shows the current setting.

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3.5 Trend or alarm display

The trend values are measured every minute and additionally on every manual NIBP measurement. The trends can be displayed in graphical or tabular form for all parameters over 24 hours.

The display interval for the table can be selected in the menu **About+/Trend**. The displayed trend table or not acknowledged alarms can be printed out by pressing the **print** button. The displayed graph cannot be printed.

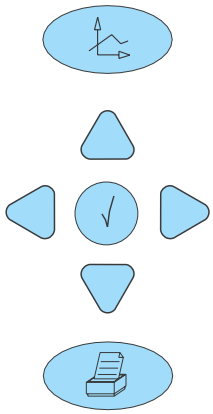

Table display

1. Press the **trend** button. The trend will be displayed in a table in 1, 5 ,15, 30, 60, 120 or 240 minute intervals. Change the displayed interval using the **up/down** button. Move the display forward/backward on the time axis using the **left/right b**utton.

Graph display (cannot be printed**)**

2. To display the graph, press the **trend** button once again. The graph's time frame corresponds to 3 hours. Display the next 3 h by pressing the **up/down** button. Move the cursor on the top right corner using the **right/left** button to display the exact measured values for the selected position on the right. The cursor can be positioned on the NIBP value by pressing **ENTER** .

Display of not acknowledged alarms

3. To display the last twelve not acknowledged alarms, press the **trend** button a third time.

3.6 Display of additional leads

The basic LCM basic serial number 0-999 can only display one lead.

1. Select the normal monitor mode. Press **menu** if in programming mode or **trend** if in trend display.
2. Press the **enter** button to switch between the normal display mode containing one lead and the 3-lead display.
3. By pressing the **up/down** buttons, the next leads are displayed.

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3.7 Procedure in case of an alarm

3.7.1 Display of alarms

During initial switching on

The alarms are suppressed for a defined time (programmable in the menu **About+/ Alarm.** Alarm suppr. time standard is 3 minutes)

The message **Alarm suppressed 3:00** appears.

During monitoring

There are two alarms:

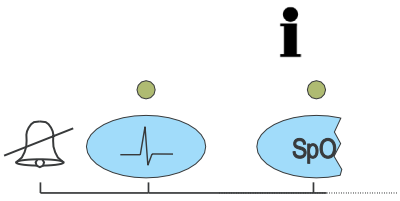
- Technical alarm, displayed in the alarm status field on the top right.
  In the case of a technical alarm, an audible alarm sounds and the measurement field for the respective value flashes.
- Physiological alarms, displayed in the alarm status field on the top left.
  In the case of a physiological alarm, an acoustic alarm sounds and the measurement field for the respective value flashes.

3.7.2 Switching off an alarm

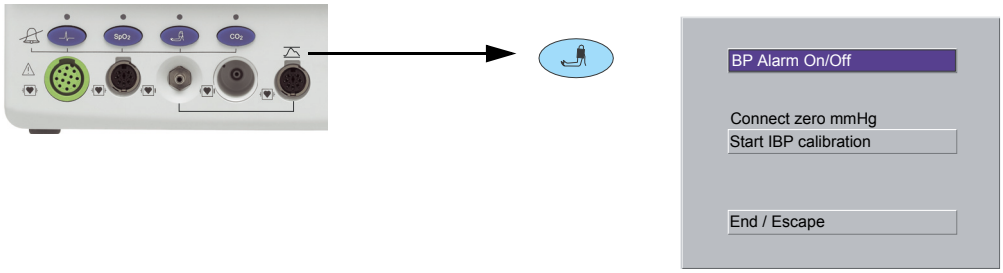
Each alarm off function is password protected. Read carefully the following warning and information:

⚠WARNING

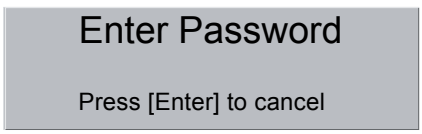
▲ When the acoustic alarm is switched off, the patient acoustic physiological alarms are silenced and suppressed indefinitely. Use this function only if disconnecting a sensor from the patient for a long period of time.



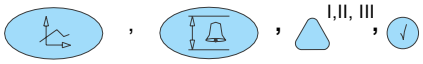
- When the **alarm off** button is pressed, the audible alarm for the respective parameter is suppressed. This is indicated by the LED above the button and a message on the monitor, e.g. **Alarm ECG OFF**. If an alarm occurs as long as the **alarm off** button is pressed, a visual alarm is displayed in the respective measurement field.
- With the LCM plus version E the access to the NIBP and IBP alarm off function will be executed by the NIBP alarm button. A menu with blood pressure alarm off (common for NIBP and IBP) and IBP calibration function appears.



Entering alarm OFF password



1. Press the desired alarm off button. The password dialog appears.
2. Press following button to enter the password:



1. The password protection can be disabled in the special menu see chapter 7.1.2 page 44

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3.7.3 Suppressing/acknowledging an audible alarm

There are two ways to proceed in the case of an alarm. The procedure depends on the set alarm stop mode **(On/Off)** and the **alarm suppression time in the menu About+/Alarm**:

(1) Alarm stop off (suppression)

This function suppresses an audible alarm for a defined period of time. However, the flashing measurement field (red measured value and coloured field) will remain.The audible alarm is reactivated after the defined period of time has elapsed.

(2) Alarm stop on (acknowledging)

This function will suppress an audible alarm as long as the defined limits are exceeded. However, the flashing measurement field (red measured value and coloured field) remains.

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3.7.4 Preventive alarm suppression

The preventive alarm suppression is used to deactivate in advance all alarms that may be caused by disconnecting patient cables, lose electrodes and relocation of the patient.

➜ Press the **alarm** button and confirm with the **enter** button before an alarm is displayed.

Message **Alarm suppressed 3:00** is displayed. The time can be programmed in the menu **About+/Alarm/Alarm suppr. time**.

The alarms are reactivated after the defined period of time has elapsed.

Removing the patient cables

When a cable is removed, the message **Cable off or no Sensor** is displayed.

➜ Press the **alarm suppressing** button.

The alarm is deleted and the measurement and wave field is no longer displayed.

3.7.5 Overview of physiological alarms

Alarm abbreviation	Description
Asys limit	Asystole time limit exceeded
SpO_2 Low/High	Oxygen saturation of the blood
PP Low/High	Peripheral pulse of SpO_2
RRi Low/High	Respiration rate impedance (from ECG electrode)
Apnea limit	Apnea time limit exceeded
CO_{2i} low/high	Inspiratory CO_2
RRc low/high	Capnographic respiration rate
eCO_2 low/high	End-tidal expiratory CO_2
SYS low/high	Systolic pressure
DIA low/high	Diastolic pressure
MAD low/high	Mean atrial pressure
HR low/high	Heart reat
Ps low/high	Invasive systolic blood pressure
Pm low/high	Invasive mean blood pressure
Pd low/high	Invasive diastolic blood pressure
Temp low/high	When the temperature is outside the measuring range, this is indicated by “<<“(15 below °C) or “>>” (above 45 °C). This limit is fixed.

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4 Start monitoring

Values are only displayed when the ECG cable or at least one sensor is connected. If a sensor is disconnected, a technical alarm is issued. The measured value will no longer be displayed if the sensor is disconnected and the alarm is acknowledged.

4.1 Connecting the cables for monitoring

1. Connect the ECG cable, the NIBP cuff, the SpO_2 sensor, the CO_2 sensor or the temperature sensor to the patient.
2. Press the **menu** button and select **System**. Select between adult, child or neonate.
3. Check the settings in the **ECG, NIBP, IBP, SpO_2** and **CO_2** panels.
4. Connect the cable to the LCM. As soon as an ECG cable or another sensor cable is connected, the corresponding indication appears on the display.
5. Press the **alarm limits** button and check the settings.
6. Check the alarm and the system statuses. (See section 2.2.3.)

4.2 ECG monitoring

WARNING

▲ In order to minimise interference and the danger of burns to the patient, only use the original SCHILLER HF ECG cables against high-frequency radiation. Keep the ECG cable as far away as possible from the operated area and the electro-surgical cables. Make sure that the electro-surgical return conductor (neutral) is well attached to the patient and that a good contact is guaranteed.

▲ Patients with a pacemaker must be observed continuously because the heart rate from the pacemaker might still be registered in case of a cardiac arrest or some arrhythimas.

– SCHILLER recommends to attach, in addition to ECG measurement, a SpO_2 sensor and adjust the alarm range of PP near to peripheral pulse.

➜ Refer to section 7.3 for ECG electrode placement.

The ECG curve field is only displayed when the ECG cable is connected and the electrodes are applied. As soon one derivation is detected the curve field will be displayed.

4.2.1 RRi monitoring with HF-ECG cable

An RRi monitoring with HF-ECG cable against high frequncy signals is not possible. The used HF-signal for the RRi measuring will be filtered by the HF protection in the ECG cable.

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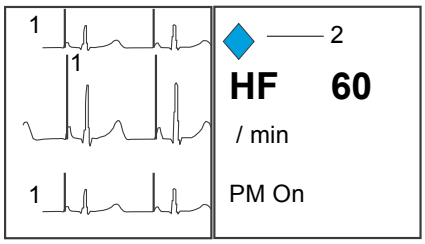
4.2.2 Pacemaker monitoring



Set the PM monitoring in the menue **ECG/Pacemaker On** to display the pacemaker pulses as vertical lines **(1)** on the ECG display. When pacemaker signals are detected, the heart symbole is replaced by a diamond **(2).** These vertical lines represent neither magnitude nor duration of the pacemaker pulse but are purely time relative.

The RRi curve field is switched of when Pacemaker detection is on.

4.2.3 Pacemaker monitoring with HF-ECG cable

Pacemaker monitoring with HF-ECG cable against high frequncy signals is not possible. The used pacemaker impulse will be filtered by the HF protection in the ECG cable.

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4.3 NIBP monitoring

⚠WARNING

- ▲ To prevent extensive pressure on the extremity, it is very important to choose the correct cuff size and to check the setting in the panel **System/Patient (Adult, Pediatric, Neonatal)**.
- ▲ In case of long-term monitoring or automatic operation, the connected body areas of the patient and the extremity to which the cuff is attached must be checked regularly for signs of ischaemia, purpura and/or neuropathy.
- ▲ The cuff must not be attached to a limb that is already used for interventions such as infusions.
- ▲ To prevent incorrect measurement results, make sure that the tube is not compressed.
- ▲ Applie the cuff always on the same level as the right atrium to be able to measure a correct arterial pressure.

i

- To prevent errors if the SpO_2 saturation is measured on the same limb as the NIBP, the SpO_2 alarm is suppressed during NIBP measurement.
  (see Menu **NIBP/SpO_2 suppression page 43.)**
- The deflation rate has an importand influence to the accuracy of the messuring special at patient with low puls. It is recommended to reduce the deflation rate for patient with bradicardia and hypotonia from 5 mmHg to 3 mmHg.

➜ The cuff is attached to the left or right upper arm.
➜ Note the cuff size for the respective patient type.

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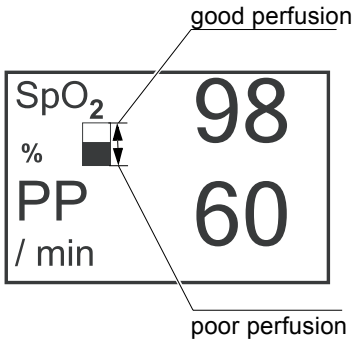
4.4 SPO_2 monitoring



- The pulsoximeter enables the continuous non-invasive monitoring of the functional oxygen saturation of the arterial hemoglobin and the pulse rate. When the signal is received from the patient sensor, the Masimo SET signal extraction technology is used to calculate the patient's functional oxygen saturation and pulse rate.
- The display shows the continuous progress of the numeric SpO2, pulse rate, plethysmographic waveform and signal quality values.
- The displayed plethysmographic waveform is not proportional to the pulse volume.
- The update period of the measurement readings on the display is 0.2 seconds.
- According to the relevant standards, the temporary alarm suppression must be set to maximally 2 minutes.
- Check low/high setting of the SpO2 sensor see chapter 7.1.2 page 44.
  Low sensitivity mode provides the best combination of sensitivity and sensor off detection performation. this mode is recommended for the majority ofr patients.
  High sensitivity mode should be used for patients, where optaining a reading is most difficult. This mode is only recommended during procedures and when clinican and patient contact is continuous.

⚠WARNING

- ▲ Only use sensors recommended from SCHILLER for SpO2 measurement with the Argus LCM. Other oxygen transducers (sensors) may lead to improper performance.
- ▲ The information in this manual does not overrule any instructions given in the Masimo operating manual, which must be consulted for full instructions.
- ▲ Do not use the pulsoximeter or Masimo sensors during magnetic resonance image scanning. Induced current could potentially cause burns, and the pulsoximetry may affect the image and the accuracy of the measurements.
- ▲ Before using the sensor, carefully read the sensor directions for use.
- ▲ Tissue damage can be caused by incorrect application or use of a sensor. Inspect the sensor site as described in the sensor directions for use to ensure skin integrity and correct positioning and adhesion of the sensor.
- ▲ Do not use damaged patient cables, damaged sensors or sensor with exposed optical components.
- ▲ Substances causing disturbances: Carboxyhemoglobin can lead to falsely high measurement readings. The degree of the deviation approximately corresponds to the quantity of carboxyhemoglobin. Colours or substances containing colours that influence the natural blood pigments can also lead to incorrect measurement readings.
- ▲ Exposure to excessive illumination, such as surgical lamps (especially those with xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps or direct sunlight, can affect the performance of an SpO2 sensor. To prevent exposure to excessive illumination, ensure that the sensor is correctly applied and that it is covered with an opaque material, if required. If these measures are neglected, excessive illumination can lead to incorrect measurements.
- ▲ Change the sensor's position at least every 4 hours.

Alarm test

1. Apply the SpO_2 sensor to the patient.
2. Set the lower SpO_2 alarm limit to 99%.
3. When the SpO_2 value is lower than the alarm limit, an alarm is issued.
4. Reset the alarm limit to its original value.

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4.5 IBP monitoring

⚠WARNING

- ▲ Carefully read the manufacturer's instructions before using the invasive blood pressure kit.
- ▲ When applying the kit to the patient, make sure that absolutely no air penetrates the system.
- ▲ To achieve correct arterial pressure measurement, the pressure sensor must be installed on the level of the right atrium.
- ▲ If the pressure sensor's position is moved after calibration, this might lead to wrong low or high values.
- ▲ If an invasive catheter for blood pressure measurement is introduced into an arterial vessel, the circulation in the terminal vessels must be checked in regular intervals.
- ▲ Single-use sensors and valves must not be reused.
- ▲ To grant the patient's safety, it must be ensured that neither the electrodes nor the patient, or persons touching the patient, come into contact with conducting objects, even if these are earthed.
- ▲ Precautions must be observed when using high frequency surgical equipment. Use high frequency protected sensors to avoid wrong IPB measurements.

- The kit and operating procedure vary according to manufacturer. Please consult the manufacturer's documentation for connection.
- For warm-up time/ready for measurement and displacement for invasive transducers, refer to the documentation of the transducer manufacturer.

4.5.1 Preparing IBP measurement

The rinse must be contained in a flexible container. This container must be surrounded by a pressure bag which should exert a pressure of 300 mmHg ± 30 mmHg on the container. This is in order to ensure a minimum flow of rinse of approximately 6 ml per hour to prevent occlusion of the catheter tip.

1. Unpack the disposable measuring kit and check all tube connections for tightness.
2. Secure the infusion bag and connect the infusion tube to the bag.
3. Hang the measuring kit in the holder and secure the holder.
4. Connect the cable of the transducer to the adapter cable.
5. Connect the cable to the unit.

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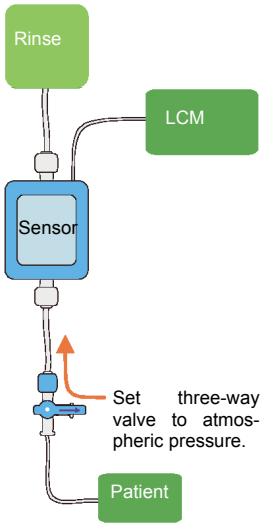
4.5.2 IBP calibration

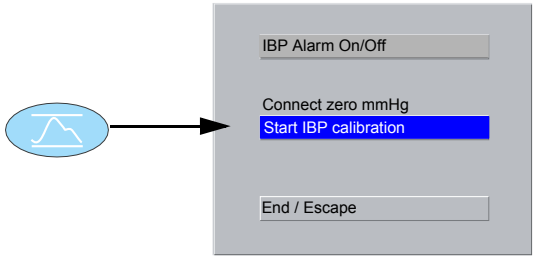
- Calibration must be carried out before every application.
- Zero point calibration is automatically carried out when the pressure sensor cable is plugged in. However, it can also be initiated manually via the **IBP** setting screen.
- In order to avoid wrong results based on physiological zero-point drift of the used sensor, recalibrate the sensor every 24 hours.

Note

If the pressure sensor's position is moved after or during calibration, this might lead to wrong low or high values.



1. In accordance with the manufacturer's instructions, open the relevant valve(s) to equalise the system pressures as is shown in this example.
2. Press the IBP alarm button.  or NIBP alarm button  with LCM version E.
3. Select **Start IBP Calibration**.



4. Confirm with **enter**.

4.6 CO_2 monitoring

WARNING

▲ Side stream waste products and the CO_2 watertrap should be treated as hazardous waste.

▲ To ensure that children and neonates have sufficient air to breathe, it is vital that the "System > Patient" ("Adult", "Pediatric", "Neonatal") and the CO_2 settings be checked. The flow rate for CO_2 measurement must be 120 ml/min for children and 90 ml/min for neonates.

4.7 Temperature monitoring

- Depending on the sensor type, the sensor can be applied to the ear, the skin or per rectum.
- The minimum measurement duration to achieve a measured value, independent of the measuring site, amounts to at least 2 minutes.

When the temperature is outside the measuring range, this is indicated by “<<“(15 below °C) or “>>” (above 45 °C). This limit is fixed.

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5 Maintenance

5.1 Maintenance interval

The software controlled devices have undergone a software risk analysis to minimise any hazards connected to software defects.

The regular system maintenance must include a software check according to the manufacturer's instructions. The test results must be recorded and compared to the values in the accompanying documents.

Maintenance work not described in this chapter, e.g. battery replacement, may only be accomplished by a qualified technician authorised by SCHILLER AG.

The following table indicates the intervals and responsibilities of the maintenance work required. Country specific regulations can prescribe additional or other intervals and examinations.

Interval	Maintenance	Responsible
Every two weeks	• CO_2 zero point calibration (see section 5.5.1)	➜ User
Every 6 months	• Visual inspection of the unit and cables • LED test (see section 3.1.1) • Keys and alarm test (see section 5.1.1) • CO_2 two point calibration (see section 5.5.2)	➜ User
Every 12 months	• All services performed in six months' intervals • Function inspections according to the instructions in the service handbook • NIBP calibration • ECG calibration • Safety test according to EN 60601-1 (1990), clauses 18 and 19	➜ Service staff authorised by SCHILLER AG
Every 24 months	• All service work performed in six- and twelve-months' intervals • All measurement inspections and calibration according to the instructions in the service handbook	➜ Service staff authorised by SCHILLER AG

5.1.1 Visual unit check

Defective units or damaged cables must be replaced immediately.

Visually inspect the unit and cables for the following damages:

➜ Device casing not deformed?
➜ Sheathings of sensor, mains and potential equalisation cables undamaged?
➜ Signal input sockets undamaged?
➜ Type plate on the rear of the unit readable?
➜ Keyboard and designation on the front of the unit readable?

5.1.2 Button test

Press all buttons and check if they work properly.

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5.2 Maintenance interval for the battery

Important
The battery is maintenance free during its normal life.

The battery should remain charged during storage. If the storage period exceeds three months, recharge the battery.

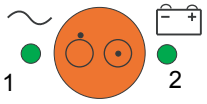
- During normal operation no maintenance necessary.
- If not used every 3 months.

Replace the battery approx. every 4 years (depending upon application) if the actual running time falls substantially under 30minutes.

5.2.1 Charging the battery

Important
A totally discharged battery requires approx. 5 hours to be 90% recharged.

It is possible to use the unit when the battery is being charged. However, when this is the case, the charging time of the battery will be substantially extended!



1. Connect the device to the mains but do not switch it on.
2. The LED for mains supply (1) is lit.
3. Charge the battery for at least 5 hours.

5.2.2 Battery disposal

WARNING

▲ Danger of explosion! Battery may not be burned or disposed of domestic refuse.
▲ Danger of acid burns! Do not open the battery.

The battery is to be disposed of in municipally approved areas or sent back to SCHILLER AG.

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5.3 Changing the fuse and mains voltage

WARNING

- ▲ The mains voltage may only be changed by qualified personnel.
- ▲ Before changing the fuse and mains voltage, disconnect the device from the mains and remove the mains plug. See section 3.2.
- ▲ Ruptured fuses must only be replaced with the fuse types indicated in the below table.

Fuse types

Voltage range	Number	Fuse types
220 - 240 VAC	2	250 V 200 mA (T)
100 - 115 VAC	2	115 V 315 mA (T)

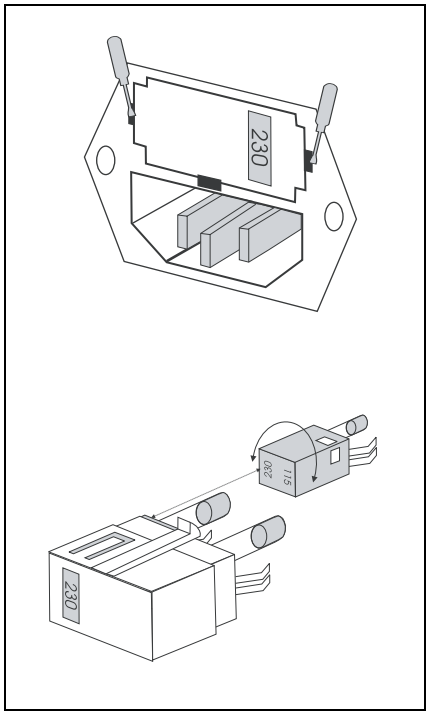

Fig. 5.1 Fuse inset

Changing the fuse

1. Disconnect the device from the mains and remove the mains plug. See chapter 3.2.
2. Loosen the fuse using a screwdriver and remove it.
3. Replace both fuses (see "Fuse types" table).
4. Reinsert the fuse inset.

Changing the mains voltage

1. Disconnect the device from the mains and remove the mains plug. See section 3.2.
2. Loosen the fuse using a screwdriver and remove it.
3. Remove the grey inset, turn it by 180° and reinsert it.
4. Check the voltage indication in the window.
5. Replace both fuses (see "Fuse types" table).
6. Reinsert the fuse inset.

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5.4 Cleaning the device, cable and sensors

WARNING

- ▲ Disconnect the device from the mains and remove the mains plug before cleaning. See section 3.2.
- ▲ Do not immerse the unit or the cable and sensors in liquid!
- ▲ Do not use aggressive cleaners.
- ▲ Reusable sensors must be treated as biologically dangerous material after usage and sterilised according to the manufacturer's instructions.
- ▲ Observe the manufacturer's notes when cleaning the sensors and cables.

5.4.1 Cleaning the device, cables and sensors

1. Disconnect the device from the mains and remove the plug and sensors.
2. Wipe the equipment, cable and sensors with a dampened cloth and a mild cleaning solution. The manufacturer recommends using 70% alcohol.
3. Dispose of single-use sensors and protective coverings according to the relevant regulations.

Notes regarding the cleaning of NIBP cuffs

The manufacturer recommends using 70% alcohol to clean the NIBP cuff and tube.

Notes regarding the cleaning of the SPO_2 sensor

The manufacturer recommends using 70% alcohol to clean the cable and sensor. Dry the sensor before reuse.

Notes regarding the cleaning of the ECG cable and electrodes

The cable can be wiped with a mild cleaning agent or with 70% alcohol. If required, sterilisation should be carried out with gas only (Alhydex or Vygon) but not with steam. Electrodes can be cleaned with soapy water after every use. Make sure that no water is left in the suction cups of suction electrodes.

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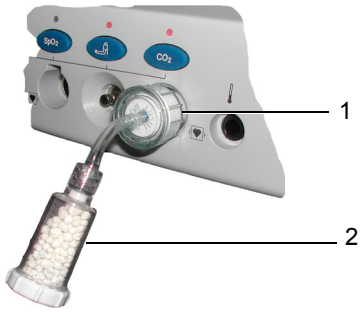
5.5 Zero and two point CO_2 calibration

- CO_2 scrubber not more than one year old.
- Watertrap
- Calibration gas 10% CO_2 Bal. N_2
- Or calibration kit including above items and accessory Art.no. 2.100741

- Calibrate the sensor's zero point voltage at dry, clean air and at room temperature.
- Zero point calibration must be carried out every two weeks. A zero point calibration is successful if the CO_2 value is in the range of 0.0% to 0.3%.
- Two point calibration must be carried out every six months. A two point calibration automatically includes zero-point calibration. A two point calibration is successful if the CO_2 value is 10% after one minute.
- The calibration date is saved by the LCM and displayed in the CO_2 settings panel. When the calibration interval has elapsed, a message is displayed.

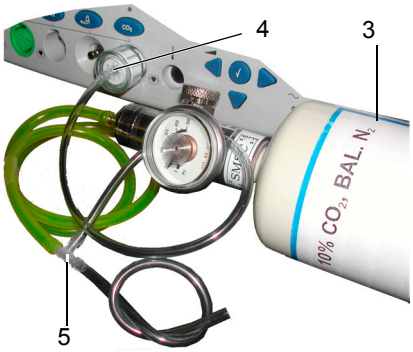
To reduce the calibration time, you can change the respiration source to CO_2 in the menu **About+/Param**. The pump starts as soon as the menu is closed.

5.5.1 Starting the zero point calibration



1. Connect the watertrap (1) to the CO_2 socket.
2. In the CO_2 screen, select **Start zero point calibration** and confirm with **enter**. The pump is started.
3. Continue with **enter**. You are prompted to connect the CO_2 scrubber.
4. Connect the CO_2 scrubber (2) to the watertrap (1).
5. Press **enter** to continue. The pump must run five min. before the calibration is carried out automatically.
6. When the calibration is finished, a message is displayed. Finish the calibration by pressing **enter**.

5.5.2 Starting the two point calibration



1. Connect the watertrap (1) to the CO_2 socket. (See zero point calibration.)
2. In the CO_2 screen, select **Start two point calibration** and confirm with **enter**. The pump is started.
3. Continue with **enter**. You are prompted to connect the CO_2 scrubber.
4. Connect the CO_2 scrubber (2) to the watertrap (1).
5. Press **enter** to continue. The pump must run five min. before the calibration is carried out automatically. When the zero point calibration is finished, you are prompted to connect the calibration gas.
6. Remove the CO_2 scrubber and connect the calibration gas (3) to the watertrap (4) using a T-piece (5).
7. Open the valve of the gas bottle. An eCO_2 value of about 10% is indicated, and the calibration is carried out.
8. When the calibration is finished, a message is displayed. Finish the calibration by pressing **enter**.

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5.6 Trouble shooting

Alarm	Cause	Remedy
ECG cable off	• ECG cable disconnected	➜ Connect the ECG cable.
ECG lead off	• Electrode lose/defective	➜ Check and reapply/replace electrodes.
SpO_2 Low Perfusion	• Bad sensor positioning	➜ Check the sensor and reapply.
SpO_2 Sensor off	• Sensor off	➜ Check the contact between the sensor and the patient.
SpO_2 no sensor	• SpO_2 sensor failed or disconnected	➜ Replace the sensor.
NIBP no module detect.	• NO NIBP module detected	➜ Switch device Off/On or replace device.
NIBP error	• NIBP module failed	➜ Replace the device.
NIBP no/off cuff	• No cuff connected or insufficiently fitted. • Pump is not running • Pump is running • Pressure offset above 10 mm/Hg see page 14	➜ Check the cuff position. ➜ Pump is mechanical blocked (call service) ➜ Pump not or wrong connected (call service) ➜ Internal tubes off (call service) ➜ Adjust the zero point of the NIBP module. Call service.
NIBP signal low	• Cuff not applied correctly • Pulse too low for good measurement • Tube too long for neonates	➜ Reposition/check the cuff. ➜ Use a tube for neonates (max. 1.5 m).
NIBP pressure range	• Pressure min. 15 mm/Hg max. 310 mm/Hg below or above the limit	➜ Check cuff and connection.
NIBP time too long	• Pumping running time exceeded (40 s for neonates, 60 s for adults)	➜ Check cuff and connection for leaks ➜ Pressure approx. 50 mmHg when pump is running check valve ➜ Internal tubings
CO_2 No watertrap	• Watertrap not connected • Microswitch defective	➜ Check the watertrap. ➜ Check the microswitch.
CO_2 module failure	• CO_2 module defective	➜ Replace the device.
CO_2 Communication	• Communication interrupted	➜ Replace the device.
CO_2 Environment dist.	• Temperature, or barometric pressure of the CO_2 sensor outside the range • Pump damaged • Air or vacuum source connected to the CO_2 input	➜ Check the environmental conditions. (call service) ➜ Inspect the pump. ➜ Inspect the connection.
CO_2 Occlusion	• Tube system clogged	➜ Check the tube system and watertrap for occlusion.
Temp. Sensor off	• Sensor removed.	➜ Reconnect the sensor.
Temp. out of range	• Temperature out of range of 15 °C to 45 °C.	➜ This limit is fixed. The display shows **"<<"**(15 below °C) or **">>"** (above 45 °C).
Temp. failed	• Sensor failed	➜ Replace the sensor.
IBP no sensor	• IBP sensor failed	➜ Replace the sensor.
IBP not calibrated	• Zero point sensor too high/low pressure higher then ± 30 mmHg or pressure variations.	➜ Check tube system, sensor and ventil ➜ Calibrate the sensor.
		Table page 1 of 2

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Alarm	Cause	Remedy
IBP Artefact	• Loose sensor contact • A manipulation at the sensor, such as rinsing, has caused variation peaks ± 150 mmHg	➜ Inspect the sensor and cable connection. ➜ After rinsing, calibrate the sensor.
IBP wrong value	• Constant pressure (± 30 mmHg) during calibration	➜ Check tube system, sensor and ventil. Set the sensor to ambient pressure ➜ Calibrate the sensor.
Paper insert	• Paper finished	➜ Insert new paper.
Check paper	• Paper jammed	➜ Check the paper.
Battery low	• Battery capacity too low	➜ Connect the device to the mains and recharge the battery.
Respiration curve field is not shown	• Pacemaker is **On** and respiration source is **ECG**	➜ Set respiration source to **CO_2** or pacemaker to **Off**.
Respiration curve is not displayed	• HF ECG cable connected	➜ Connect standard ECG cable
No QRS sound	• Setup QRS source	➜ Set QRS source to SpO_2 or ECG
Pacemaker pulse is not displayed	• The pacemaker impulse will be filtered by the HF protection in the ECG cable.	➜ Connect standard ECG cable
		Table page 2 of 2

5.6.1 Accessories and disposables

⚠WARNING

▲ Always use SCHILLER replacement parts and disposables, or products approved by SCHILLER. Failure to do so may endanger life and invalidate the guarantee.

Your local representative stocks all the disposables and accessories available for the Argus LCM. A full list of all SCHILLER representatives can be found on the SCHILLER website (www.schiller.ch). In case of difficulty, contact our head office in Switzerland. Our staff will be pleased to help process your order or to provide any details for all SCHILLER products.

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6 Technical Data

6.1 System data

Manufacturer	SCHILLER AG
Device type	ARGUS LCM/PLUS monitoring system
Dimensions	290 x 275 x 180 mm (h x l x w)
Weight	4.6 kg
Protection case	IP20
Power supply	
Voltage	100 - 115 VAC or 220 - 240 VAC 50/60 Hz
Power consumption	28 VA
Battery operation	Up to 1 hour, option with additional battery 2 hours
Fuses	2 x 200 mA (T) at 250 VAC, 2 x 315 mA (T) at 115 VAC
Boardnet supply	11-30 VDC max. 2.5 A The unit is suitable for use in networks according to CISPR 11.
Environmental conditions	
Operating temperature	10 ºC .. 40 Cº relative humidity at 25-95% (noncondensing)
Storage temperature	-10 ºC ... 50 Cº relative humidity at 25-95% (noncondensing)
Atmospheric pressure	700 ... 1060 hPa
Display	Colour TFT-LCD, backlit
Resolution	SVGA 800 x 600 dots
Dimension diagonal	27 cm, 10.4″
Printer	High resolution thermo-printer
Resolution	8 dots/mm (amplitude-axis), 40 dots/mm (time-axis) at 25 mm/s,
Paper	Thermoreactive, Z-folded, 72 mm width, length approx. 20 m
Print speed	25 mm/s
Printout length	10 second ECG records (equal 4 pages)
Recording tracks	3-channel display, with optimal width of 72 mm, automatic baseline adjustment
Battery	
Battery type	Leakproof, rechargeable lead acid battery
Recharging time	90% full: Approx. 5 hours, 100% full: Approx. 15 hours
Life	Approx. 4 years
Connections	ECG patient cable, SpO_2, NIBP, CO_2, temperature, invasive pressure,
Interfaces	• RS-232 • Nurse call (alarm delay at the signal output component < 0.5 s)

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Monitoring functions	
Display	• All vital data numerical and/or graphical
Trend	• All vital data are stored for up to 24 h and can be displayed in tabular or graphical form in intervals of 1, 5, 15, 30, 60, 120 or 240 minutes.
Alarm limits	• The upper and lower limits can be defined freely for all vital data (exception for temperature: only numerical display).
Safety standard	• IEC/EN 60601-1, protection class I, CF classified (with internal power supply) • IEC/EN 60601-2-27
EMC	IEC/EN 60601-1-2
Additional requirements	EN 1060-1 and 3 (non-invasive blood pressure recorders part 1)
Conformity	CE according to directive 93/42/EEC class IIb

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6.2 Technical data - measured values

6.2.1 ECG

Leads	Simultaneous, synchronous recording of all 9 active electrodes giving 12 leads
Patient cable	3p-, 3-,5-, 10-lead cable
Heart rate	20 – 250 beats/min
Lead display	Selection of 1 or 3 simultaneous leads
Sensitivity	5/10/20/40 mm/mV programmable
ECG amplifier	
Sampling frequency	1000 Hz
Pacemaker detection	≥± 2 mV/≥0.1 ms
HF calculation	8 beats
Line frequency filer	Distortion-free suppression of superimposed 50 or 60 Hz sinusoidal interferences by means of adaptive digital filtering
ECG baseline drift (LCM plus)	<< 0.5 mV
Pacemaker	Amplitude 1...2 mV, atrial and ventricular
ECG Filters	
Diagnostic (Hardware filter)	High/low-pass: hp = 0.05 Hz, lp = 150 Hz for LCMplus and LCMbasic SN < 1000
Monitoring 1 (Hardware filter)	High/low-pass: hp = 0.5 Hz, lp = 40 Hz for LCMbasic SN > 1000
Monitoring 2 (Hard & Software)	Hardware see above, SW_{hp} = 0.6 Hz, SW_{lp} = 35 Hz
Artefact (Hard- and Software)	Hardware see above, SW_{hp} = 2.4 Hz, SW_{lp} = 20 Hz
Mains filter	50/60 Hz
Pacemaker detection	
Amplitude	> 2 mV
Puls width	> 0.1 ms

6.2.2 Respiration

Measuring method	Impedance method with 3p-, 3-,5-, 10-lead cable
Sampling frequency	250 Hz
Measurement range	Apnea, respiration rate 0-200 inspirations/min
Calculation	8 breats
Trigger point calculation	32 s
Impedance range	0.1 - 3 Ohm

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6.2.3 Temperature

Sensor	YSI 401, rectal, skin or ear
Measurement interval	1x per second
Measurement range	15 °C to 45 °C
Resolution	0.1 °C
Minimum measurement duration	2 min until a measured value is achieved

6.2.4 NIBP - non-invasive blood pressure

Measurement	Automatic or manual
Measuring method	Oscillometric
Measurement range	15 to 300 mmHg
Accuracy	
Max. mean error	± 5 mmHg
Max. standard deviation	± 8 mmHg
Deflation rate	3 to 9 mmHg

6.2.5 IBP - invasive blood pressure

Measurement range	-20 ... 300 mmHg
Sampling rate	500 Hz
Accuracy	• 1 mmHg at 0...100 mmHg or • ±1% at 100...300 mmHg • other sensors may cause lower accuracy
Calibration	Manual
Pulse calculation	8 beats

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6.2.6 SpO_2 - pulsoximetry

Amplifier	Masimo™ MS-3, MS-7, NELL-1
Operation	Normal and sensitive
Sampling rate	62.5 Hz
Accuracy	**SpO_2** • Adults 70 to 100% ± 2 digits • Neonates 70 to 100% ± 3 digits **PP** • 30 ... 199/min ± 4 digits
Calibrated range	70 ... 100% (calibraton is fixed, no calibration required)
Measurement range	**SpO_2** 1 ... 100% **PP** 25 ... 240/min
Displayed range	1 ... 100%
PP calculation	8 s

6.2.7 $etCO_2$ - capnography

Measuring method	Side stream
Displayed range	0 ... 99 mmHg
Suction rate	90/120/200 ml/min
Accuracy	± 3 mmHg at 0 ... 40 mmHg ± 8 mmHg at 41 ... 76 mmHg ± 10 mmHg at 77 ... 99 mmHg
Respiration rate	0 ... 99 inspirations/min
Environmental pressure compensation	Automatic when the unit is switched on and when the watertrap is inserted.

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7 Appendix

7.1 Settings menu

7.1.1 Main menu

Bold marked values are factory settings.

Main menu	Parameter	Values
ECG	Display sensitivity	5/**10**/20/40 mm/mV
	[a]ECG - Filter	[a]**Diagnostic/** Monitoring 1 / Monitoring 2 / Artefact
	QRS beep source	**Off**/ ECG/ SpO_2
	Pacemaker	**Off** /On (If pacemaker on, it is no RRi measuring possible)
	RRi Alarm	**On** /Off
	Cable mode	**Automatic** /3-/5-/10-or 3p electrodes
	Mains filter	**Off**/ 50 or 60 Hz
NIBP	Initial pressure	Adult 180, pediatric 150, neonatal 120 mmHg (0..300)
	Autom. measuring	**Off/** On
	Interval time	2/3/5/10/15/ **30**/60 min
	Deflation speed	**5** (3..9)
	SpO_2 suppression	Off/ **On**
IBP	Scale	0..**300**/200/100/50/30/Auto
	Start IBP Calibration	Function
CO_2	Flow Rate	**200**/120/90 ml/min (See chapter 7.4 for more details)
	O_2-Compensation	**Off/** On (Off = $O_2 \leq$ 60 % / On = $O_2 >$ 60 %)
	N_2O Compensation	**Off/** On (Off = 0% N_2O /On = $\geq$ 12 %)
	Desflurane compensation	**Off/** On (On = Desflurane $\geq$ 12 %)
	Steam compensation	**Off/** On
	BTPS compensation	**Off/** On
	Zero point cal. date	ddmmjj
	Two point cal. date	ddmmjj
	Start zero Point Calibration	Function
	Start two-Point Calibration	Function
System	Patient	**Adult/**Pediatric/Neonatal
	Date	ddmmjj
	Time	hhmm
About	Device info	see section 7.7.2

a. Diagnostic (Hardware filter): High/low-pass: hp = 0.05 Hz, lp = 150 Hz for LCMplus and LCMbasic SN < 1000
Monitoring 1 (Hardware filter): High/low-pass: hp = 0.5 Hz, lp = 40 Hz for LCMbasic SN > 1000
Monitoring 2 (Hard & Software):Hardware see above, SW_{hp} = 0.6 Hz, SW_{lp} = 35 Hz
Artefact (Hard- and Software): Hardware see above, SW_{hp} = 2.4 Hz, SW_{lp} = 20 Hz

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7.1.2 Special menu “About+”

⚠WARNING

▲ Only authorised personnel trained in the operation of this device are allowed to do the setups in this menu.

The extended menu **About+** is displayed by pressing the following button combination:

Press  ; select **About**; press  and then 

Main menu extended	Parameter	Value
About+		
Alarm	Alarm stop mode	On/**Off**
	Alarm suppr. time	**2** min (2 ... 10)
	Alarm sound	**DIN EN 475**/Standard
	Nurse call	**Immediately**/in 5 sec.
	Alarm restriction (see page 22)	**On**/Off
Param	Lead	**II**
	Lead speed	12.5/**25**/50 mm/s
	Respiration source	[a]**ECG**/CO_2
	Respiration speed	**6.25**/12.5 mm/s
	SpO_2 Pulse	4/**8** or 16 s
	SpO_2 sensitivity	**Low** /High
	NIBP adult Initial	**180**
	NIBP pediatric Initial.	**150**
	NIBP neonatal Initial	**120**
	NIBP MAP	**On**
	Temperature unit	**°C** /°F
	CO2	**mmHg**/kPA/Vol %
Trend	View time	1, 5, 15, **30,** 60, 120, 240 min
Device	Language	**English**/Deutsch/[b]Français/Svenska/American/Italiano/Español/Portuges/Norge
Software	Save as default	With this function, changed values can be permanently saved. (See section 3.4.2.)
	Restore defaults	With this function, the saved default values can be restored. (See section 3.4.2.)
	Factory defaults	Restores the SCHILLER factory settings. The display language is changed to German. (See section 3.4.3.).
	Service	For service only NIBP update or ECG electrode test.
	Program update	For service only

a. When the set respiration source is ECG and the pacemaker is on, respiration measurement via the ECG is not possible. The respiration wave field is not displayed in this case.
b. The Russian language requires a separate software.

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7.2 Factory settings

These values can be loaded from the menu About+/Software. See chapter 7.1.2.

Parameter	Abbrev.	Unit	Type	Limit	Step	Alarm Prio.	Adult	Child	Neonat
Heart rate	HR	min	High	80...220	5	Low	140	180	200
		min	Low	15...100	5		50	70	90
Asystole		s		2...20	1	High	2	2	2
Respiration	RR	min	High	25...120	5	Low	35	35	60
		min	Low	1...20	5		6	12	20
Apnea		s		15...45	1	Low	20	15	10
NIBP	SYS	mmHg	High	80...300	5	Low	180	180	80
		mmHg	Low	10...150	5		100	100	50
	DIA	mmHg	High	30...120	5	Low	95	95	45
		mmHg	Low	0...80	5		40	40	30
	MEAN	mmHg	High	0...200	5	Low	140	140	45
		mmHg	Low	0...100	5		70	70	30
	Pulse	min	High	80...220	5	Low	140	180	200
		min	Low	15...100	5		50	70	90
Pulsoximetry	SpO_2	%	High	80...101	1	High	101	101	98
		%	Low	70...99	1		90	89	88
	PP	min	High	80...220	5	Low	140	180	200
		min	Low	15...100	5		50	70	90
Capnography	$eC0_2$	Vol%	High	4.5...10	0.1	Low	6.0	6.0	6.0
		Vol%	Low	0...6.0	0.1		4.5	4.5	4.5
	CO_2i	Vol%	High	0.1...1.5	0.1	Low	0.2	0.2	0.2
		Vol%	Low	0...1	0.1		0	0	0
	eCO_2	kPa	High	4.5...10	0.1	Low	6.0	6.0	6.0
		kPa	Low	0...6.0	0.1		4.5	4.5	4.5
	CO_2i	kPa	High	0.1...1.5	0.1	Low	0.2	0.2	0.2
		kPa	Low	0...1	0.1		0	0	0
	eCO_2	mmHg	High	35....76.0	0.5	Low	45.0	45.0	45.0
		mmHg	Low	0...45.0	0.5		35.0	35.0	35.0
	CO_2i	mmHg	High	1...10.0	0.5	Low	1.5	1.5	1.5
		mmHg	Low	0...8.0	0.5		0	0	0
IBP	Ps	mmHg	High	0...300	1	Low	180	180	180
		mmHg	Low	-20...150	1		95	95	95
	Pm	mmHg	High	0...200	1	Low	100	100	100
		mmHg	Low	-20...150	1		50	40	40
	Pd	mmHg	High	0...120	1	Low	100	100	100
		mmHg	Low	-20...80	1		40	40	40
T_1	T_1	°C or °F	No alarm	No settings	-	-	-	-	-

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7.3 Connecting the ECG patient cable

Important

The guidelines for patient electrode placement are provided as an overview only. They are not a substitute for medical expertise.

RRi

An RRi monitoring with HF-ECG cable against high frequncy signals is not possible. The used HF-signal for the RRi measuring will be filtered by the HF protection in the ECG cable.

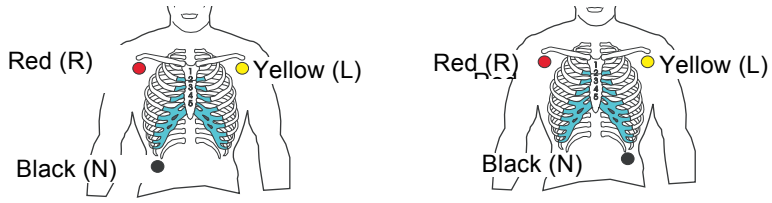
Pacemaker monitoring with HF-ECG cable

Pacemaker monitoring with HF-ECG cable against high frequncy signals is not possible. The used pacemaker impulse will be filtered by the HF protection in the ECG cable.

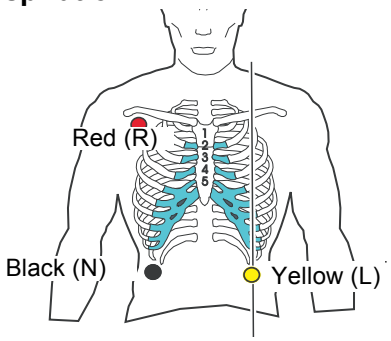
WARNING

▲ Danger of destroying the device during defibrillation! The device is only type CF protected if the original SCHILLER patient cables are used.

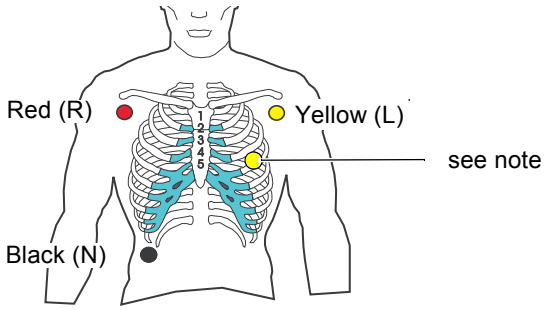
7.3.1 3-leads cable for children and neonates



7.3.2 3-lead cable for respiration



7.3.3 3-lead cable for adults



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Note

When the signal amplitude is < 0.5 mV, place the yellow electrode according the following picture instead to adjust the resolution to 40 mm/V. Because of that the artefacts can be reduzed.The signal amplitude is influenced by the electrical heart axis.

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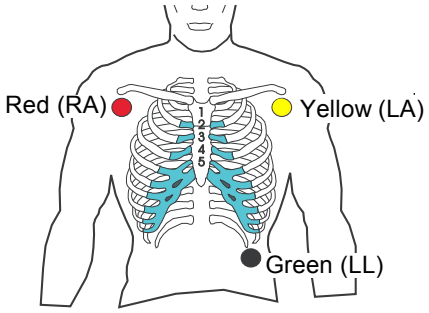
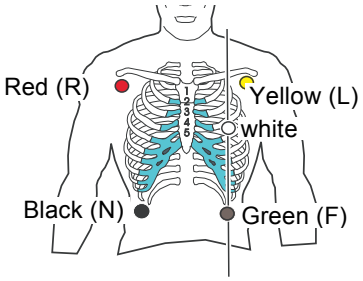
7.3.4 3p-lead cable

The ARGUS LCM BASIC Serial number > 1000 with the microprocessor MK19-11 has a new ECG amplifier (3p). It is now possible to display 6 leads with a 3p-lead cable. The 3p-lead cable is marked with an black connector housing instead of green. This works only with software 1.24 and higher.



7.3.5 Three- and five-lead cables for adults and children



The colours shown here are according to code 1 (European) requirements. In paragraph 7.3.7, you can find a table with the colour codes of the American Heart Association (AHA).

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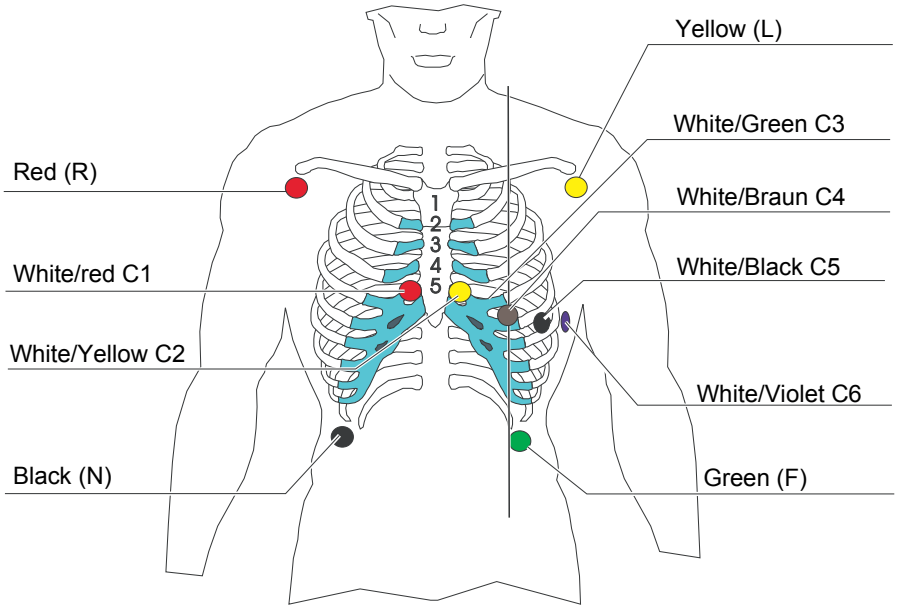
7.3.6 10-lead ECG patient cable

The following illustration indicates the placement locations for the electrodes of a ten-lead patient cable.



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7.3.7 Electrodes identification and colour code IEC/AHA

The electrode placements shown in this handbook are labelled with the colours according to code 1 requirements. The equivalent code 2 colours are given below.

	CODE 1 (usually European)		**CODE 2 (usually American)**	
System	Electrode identifier	Colour code	Electrode identifier	Colour code
Limb	R	Red	RA	white
	L	Yellow	LA	Black
	F	Green	LL	Red
Chest according to Wilson	C	white	V	Brown
	C1	White/red	V1	Brown/red
	C2	White/yellow	V2	Brown/yellow
	C3	White/green	V3	Brown/green
	C4	White/brown	V4	Brown/blue
	C5	White/black	V5	Brown/orange
	C6	White/violet	V6	Brown/violet
Neutral	N	Black	RL	Green

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7.4 CO_2 settings

7.4.1 Description of CO_2 parameters

Parameter	Setup	Description
Flow rate	**200**/120/90 ml/min	To ensure that children and neonates have sufficient air to breathe, it is vital that the "System > Patient" ("Adult", "Pediatric", "Neonatal") and the CO_2 settings be checked. The flow rate for CO_2 measurement must be 120 ml/min for children and 90 ml/min for neonates.
O_2-Compensation	Off/On	**Correction factor for O_2 = 1.03** Additional oxygen O_2 in the CO_2 gas mixture reduces the IR absorption in the sensor. This leads to too low results when the CO_2 is measured. The correction is activated when the O_2 values are greater than 60 %.
N_2O-Compensation	Off/On	**Correction factor for N_2O (laughing gas) = factor 0.952** Additional N_2O increases the IR absorption. However, N_2O does not influence the IR absorption directly but reduces the CO_2 molecule's absorption energy. The CO_2 molecule can therefore absorb more energy (IR radiation).
Desflurane Comp.	Off/On	**Correction factor for desflurane = 0.952, as for N_2O.** The compensation is activated when the desflurane concentration is greater than 12 %. However, it has the same effect as N_2O compensation.
Steam Compensation	**On**/Off	Steam affects the IR absorption by CO_2 molecules. Its influence is calculated mathematically. The compensation is activated during normal side-stream measurement. During control loop measurement, e.g. CO_2 in the incubator, the compensation is deactivated.
BTPS compensation	**On**/Off	**B**ody **t**emperature, ambient **p**ressure, **s**aturated with steam. This factor compensates differences regarding humidity saturation in inspired and expired air. This compensation is used for side-stream measurement, as the device assumes 100 % humidity and a temperature of 37 °C for expired air.

7.4.2 Compensation settings

O_2<-Compensation	N_2<O-Compensation	Desflurane Comp.	Condition
Off	Off	Off	O_2 less than 60 %, no N_2O or 25 % N_2O and 75 % O_2.
On	Off	Off	O_2 grater than 60 %, no N_2O
Off	On	Off	N_2O greater than 12 %
Off	Off	On	Desflurane greater than 12 %
On	On	Off	O_2 greater than 60 %, N_2O greater than 12 %

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7.4.3 Combination of N_2O and O_2 compensation

As the influence on N_2O is greater than on O_2, the influences can cancel each other out in a gas mixture of 25 % N_2O and 75 % O_2. In that case, both compensations can be deactivated. The overall correction when both compensations are active is 0.99.

7.4.4 Environmental pressure compensation

The environmental pressure is automatically compensated when the unit is switched on or the watertrap is connected.

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